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(56) Documents cited

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(58) Field of search

UK CL (Edition K) A3V

INT CL<sup>5</sup> A61F 13/62 13/66

(54) Absorbent article, especially diaper, with hook and loop fastenings

(57) A disposable diaper includes a hook and loop system 31, 51 for closing and opening the waistband. The hook material 31 is mounted on tabs 30 connected to the ears 17, 18 of the rear waistband portion. The loop material 51 is adhesively backed at 52 and is carried on the tabs 30 in releasable and refastenable engagement with the hook material 31. Upon first use of the diaper, a release paper 53 covering the adhesive 52 is removed and the loop material is then selectively positioned on the backsheet surface of the other waistband portion and forms a stronger bond therewith than that between the hook and loop system, whereby the latter becomes the means for subsequently closing and opening the waistband. Instead of using release paper 53, the adhesive 52 may be protected by folding the protruding portion of the tab 30 inwardly.

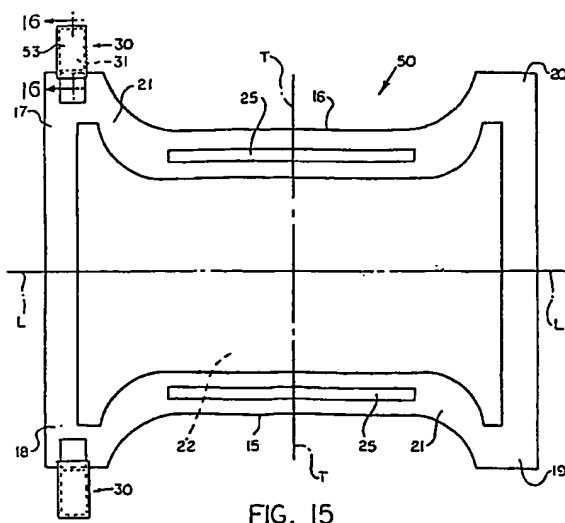


FIG. 15

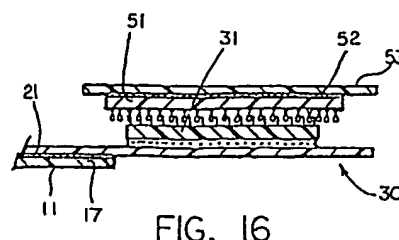


FIG. 16

The date of filing shown above is that provisionally accorded to the application in accordance with the provisions of Section 15(4) of the Patents Act 1977 and is subject to ratification or amendment.

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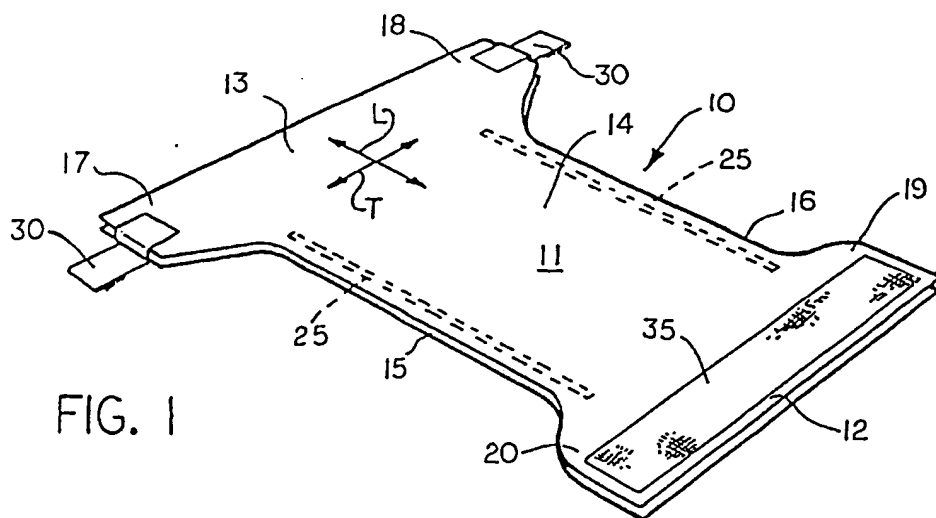


FIG. 1

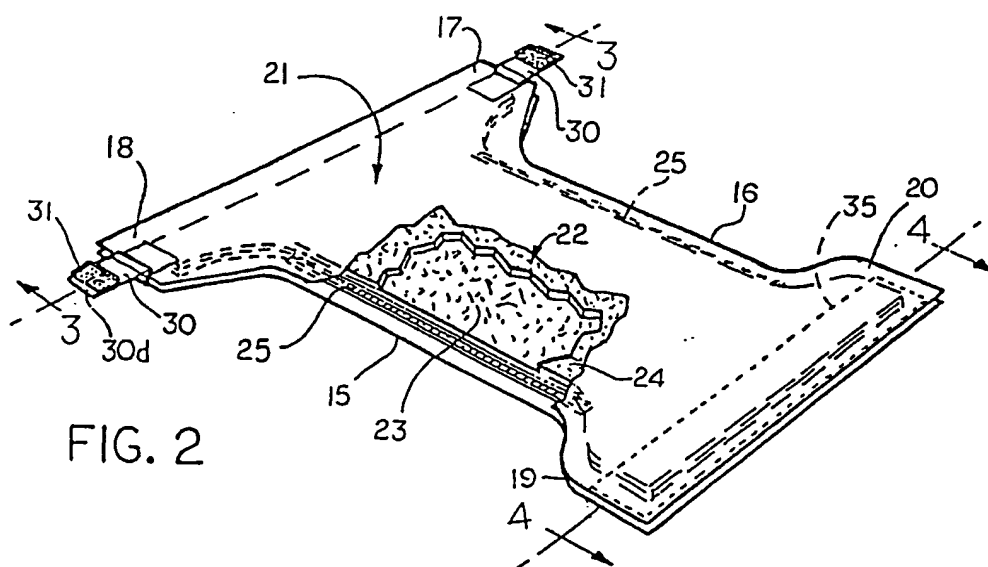


FIG. 2

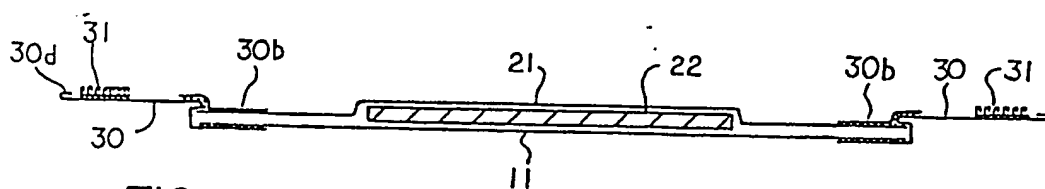


FIG. 3

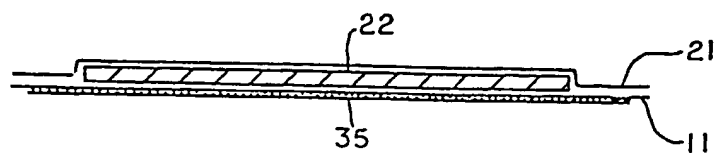
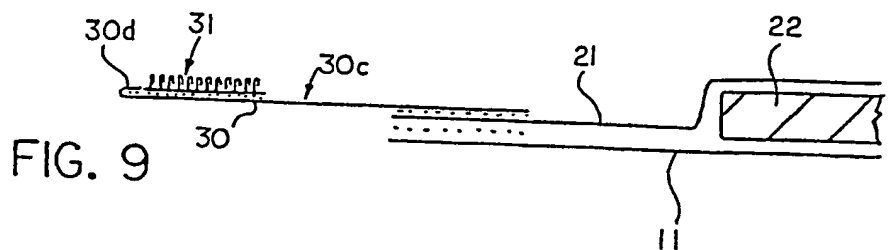
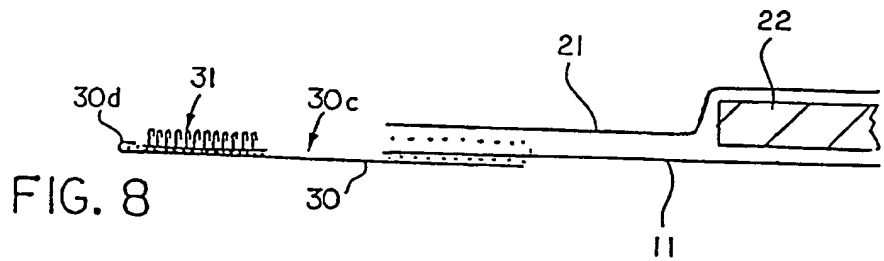
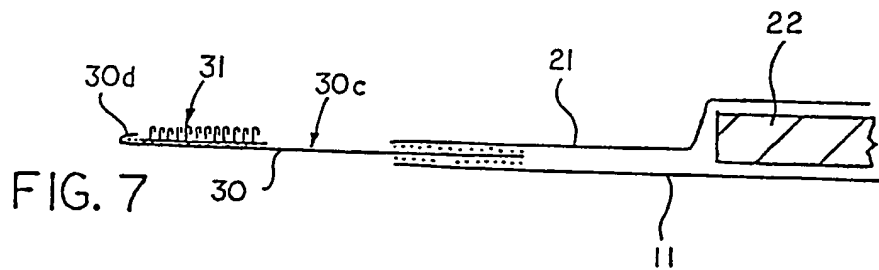
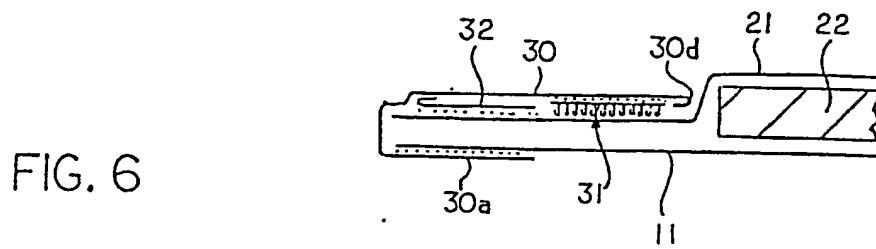
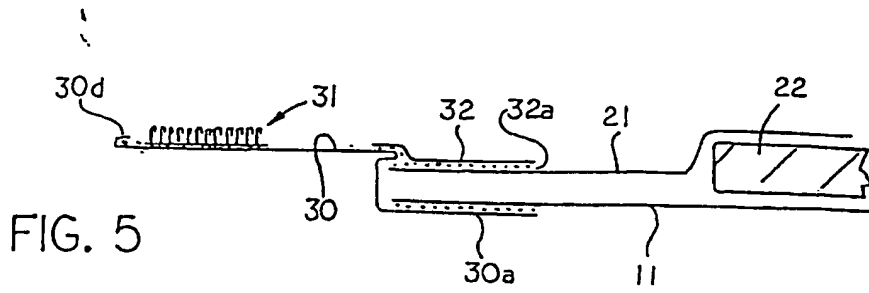


FIG. 4



[illegible]

FIG. 12

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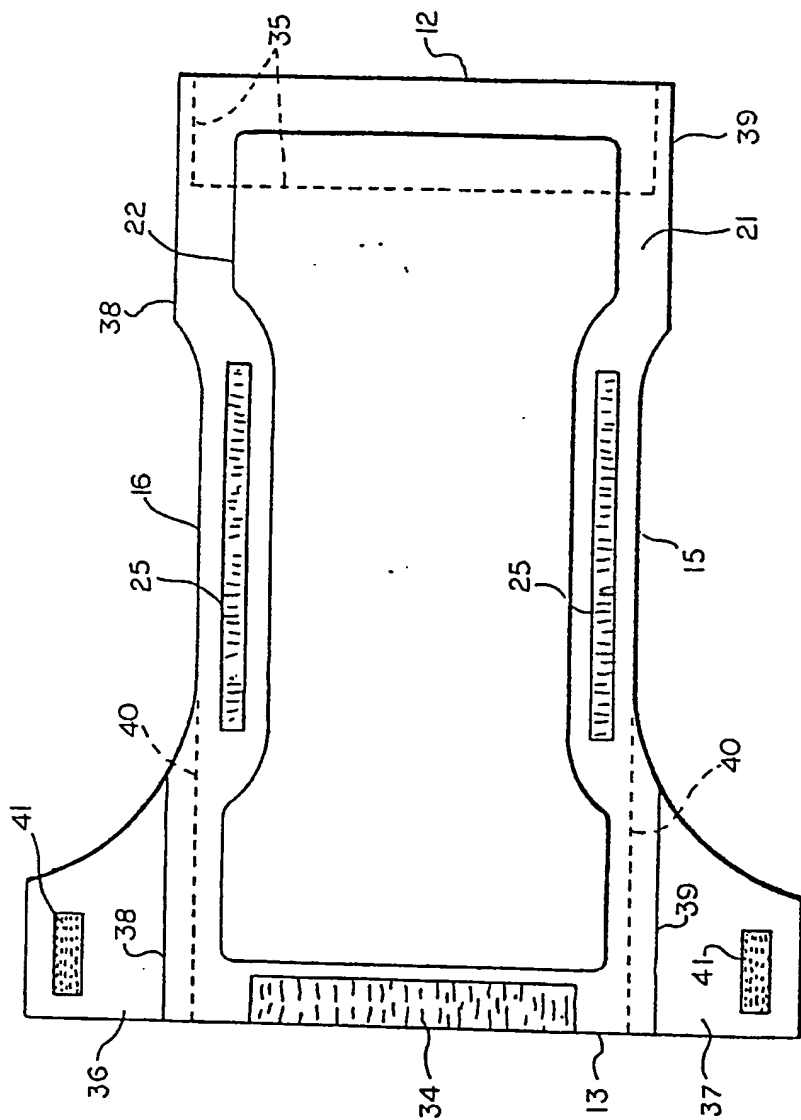
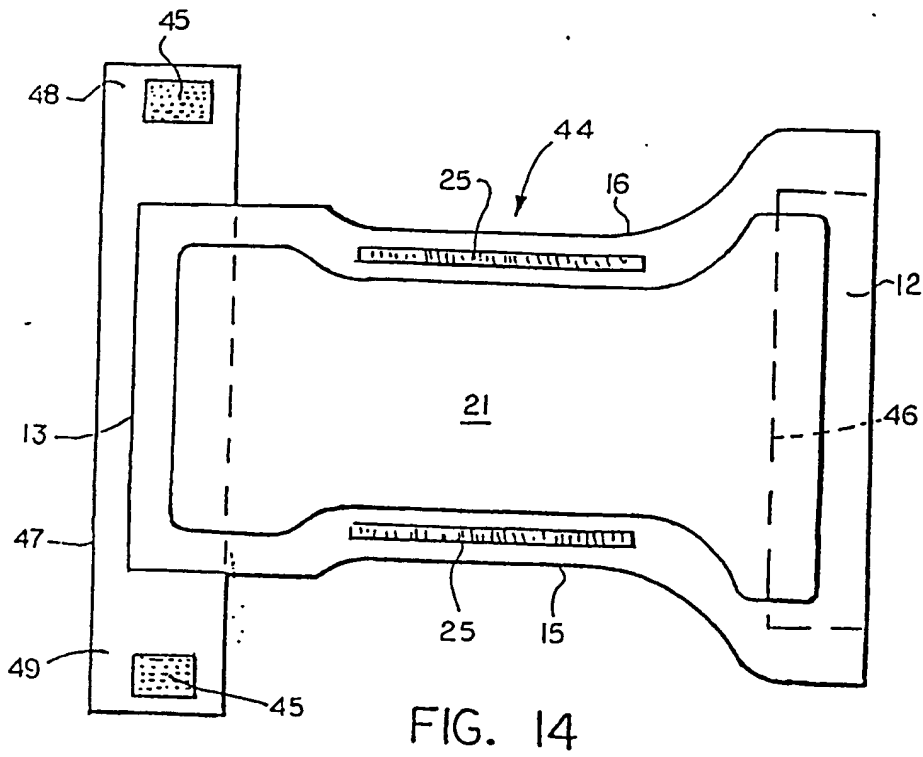
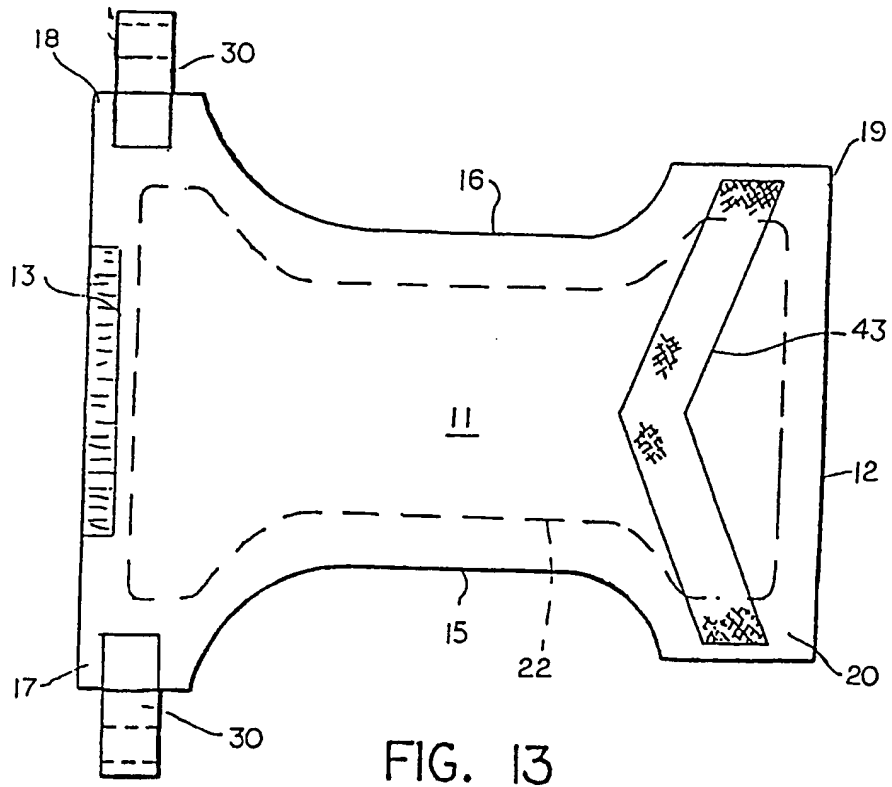


Fig. 11





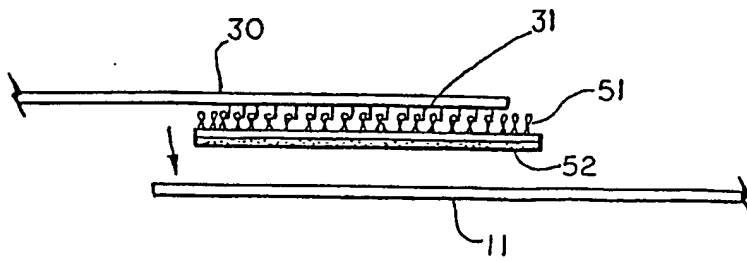


FIG. 17

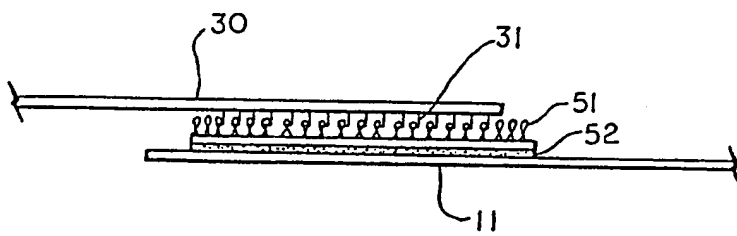


FIG. 18

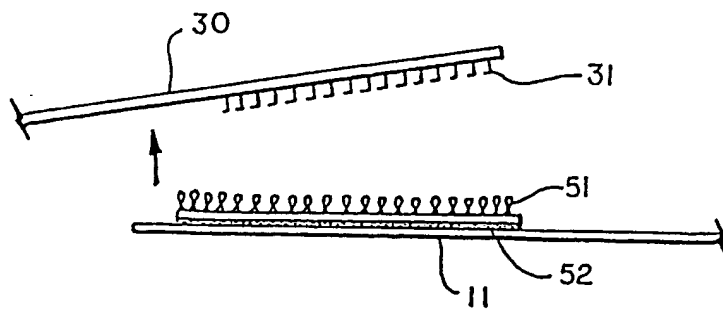


FIG. 19



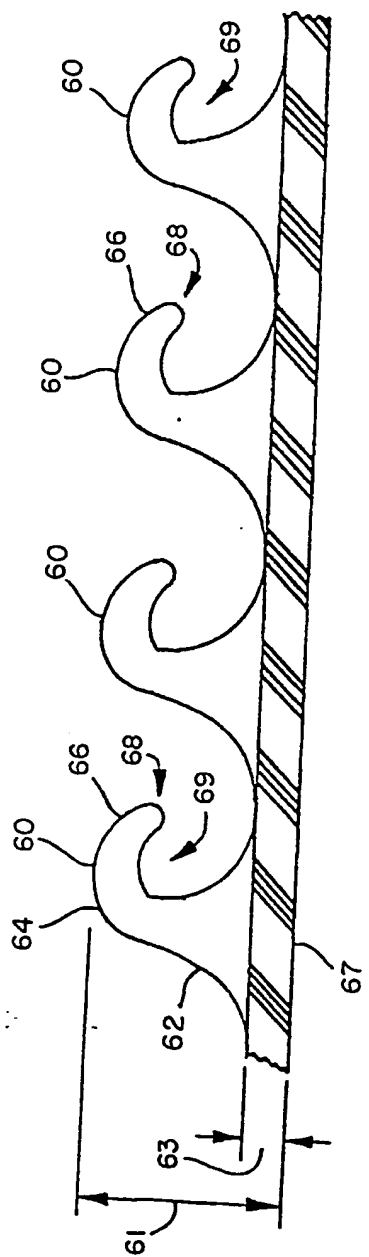


FIG. 20

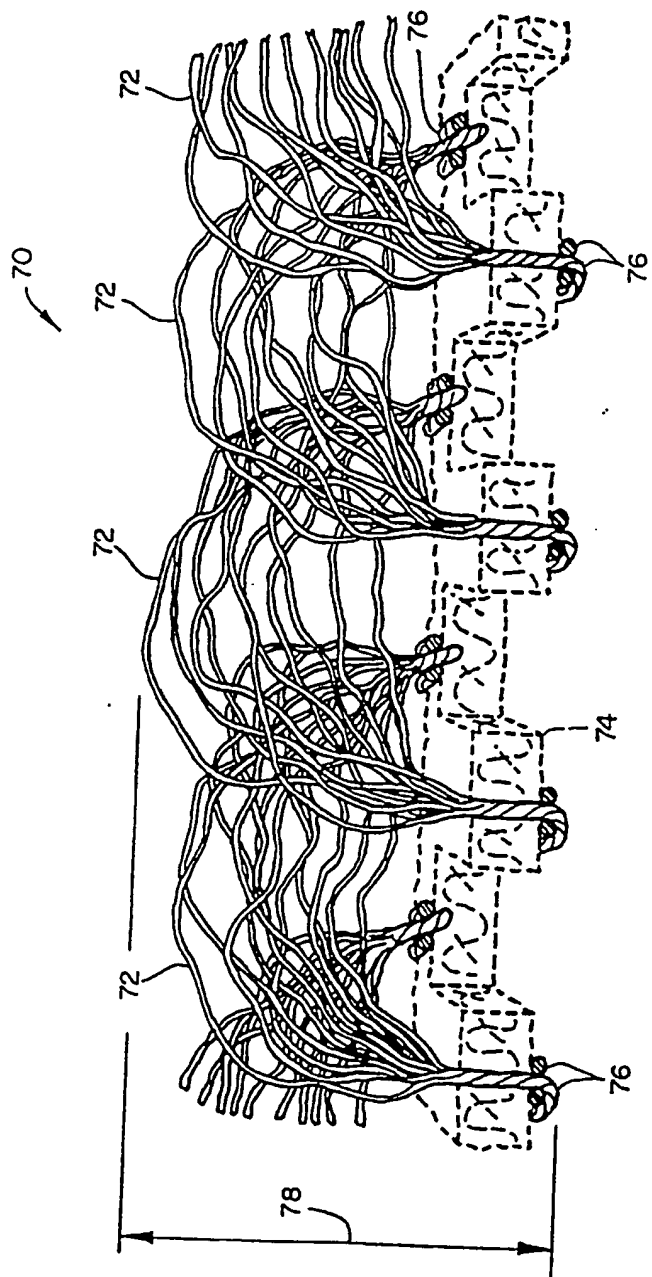


FIG. 21

ABSORBENT ARTICLE WITH IMPROVED MECHANICAL-  
FASTENING SYSTEM

5

The invention relates to an absorbent article, such as a diaper, incontinence garment or the like, and more particularly to an improved fastening system for securing the placement of the absorbent article on the  
10 body of the user.

Various fastening devices for disposable diapers have been employed for fastening the waistband portion about the torso of the user. Among these are adhesive fastening devices, such as shown in U.S. Patents  
15 3,180,355; 3,630,201; 4,047,530; 4,049,001; 4,050,453 and French Patent 7,436,169. The fastening device generally comprises an adhesive tab attached to the outer (backing) sheet of the diaper at the rear portion and the active adhesive surface of the tab is stuck onto  
20 another portion of the backing sheet surface near the front portion thereby closing the diaper. The adhesive system of diaper closing may need repeated reopening and reclosing to check the user's condition or whether the diaper needs changing. In use, the diaper may stretch  
25 or otherwise become loosened, thereby resulting in applying the adhesive portion of the tab in a new zone on the backsheet surface. Failure of the diaper may result if the tab adhesive becomes contaminated with baby powder, oil or the like; or should the tab and  
30 backsheet adhesion result in a tear or the area where the tab is initially applied. The torn area of the backsheet of the diaper will stay adhered to the tab. In either event, the reclosing of the diaper is ineffective, at least insofar as the tab is concerned,  
35 which results in premature failure of the diaper and its unnecessary disposal.

The problem of tearing the backsheet (liquid-

impermeable) material by unfastening of the adhesive tab has been dealt with by providing a region of reinforcement on the backsheet in the normal landing zone for the tab of the adhesive surface.

5        Mechanical fastening systems have been devised which provide for repeated refastening of the diaper garment, such as is disclosed in copending application, United States Patent Application Serial No. 089,660, filed August 25, 1987, and owned by the assignee of the present application. The fastening system of the  
10        copending application utilizes a plurality of cooperating snap fasteners along the sides of the diaper extending in their fixed point placement in the span from the waistband to the leg opening, and the snap  
15        fasteners provide a primary closure of the garment on the wearer along the sides in the waist-to-leg span. This is supplemented by a secondary closure effecting a continuous closure between the spaced-apart snap fasteners and provide a full length fastening in the  
20        span from the waist to leg region. The secondary closure is disclosed as cohesive adhesive strips in one form, or as an alternative a hook and loop fabric fastener tape, referred to as Velcro<sup>(R)</sup> fastener materials, placed between the snaps and along the tape  
25        extending on the sides of the diaper between waistband and leg opening. The hook and loop fastener is disclosed as a "velcro-type fastener", which provides the means for securing the waistband around the body of the wearer. Another mechanisal system for diaper  
30        closing is described in a published French Patent Application No. 2,594,650, in which there is generally disclosed an arrangement of tabs attached to the ends of the rear waistband provided with hook fasteners which fasten to a strip of loop material attached to the  
35        exterior surface at the front of the diaper.

According to one aspect of the present invention there is provided an absorbent article comprising: a

superposed backsheet, absorbent body and topsheet elements formed in composite structure having a selected shape, opposite, longitudinal end portions of said composite providing front and rear waisband portions, respectively, adapted to encircle the body of a user, a means attached to said composite for fastening the front and rear waistband portions to each other comprising: hook and loop fastener comprising two interlocking materials, one being a hook material and the other being a loop material, one of said two materials being attached to each of the lateral end portions of one of said waistband portions, and the other of said two materials being attached to said other of the waistband portions, the said materials being engageable to attach the front and rear waistband portions to each other upon encircling the body of the user, said hook material comprising a polymeric base material of about .008 - .01 inch thickness having a flexural modulus of about 70,000 to 120,000 psi, a Shore hardness of about D-40 - D-80, and the hook configurations thereof being tapered base to tip, and having a caliper in the range of about 0.035 to 0.050 inch, said hook and loop fastener having properties of shear of about 6.6 to 20 psi and peel of about 200 - 1200 grams per inch of width.

Preferably, the hook material is moulded polyolefin.

Preferably, the hook design is tapered base to top with alternating hook design. The preferred hook density is in the range of 440-1040 hooks per inch. The preferred row density is in the range 20-60 rows per inch. The base polyolefin film of the hook materials can have a thickness in the range from about 0.005 to .025 inches. Preferably however, it has a thickness within the range of about .008 to .010 inches.

In a preferred embodiment of the invention the loop material is a fabric of raised loop construction, stabilized through napping and thermosetting such that

the loops are erect from the base material.. Preferably, the fabric is two bar warp knit construction. Preferably, the warp knit fabric has from 21 to 41 courses per inch and from 26 to 46 wales per inch. The material of the fabric preferably comprises polyester yarn. Preferably, 15 - 35% of the yarn is composed of yarn having about 15 or less filaments, such yarn having a yarn denier within the range of about 15-30d and about 65 - 85% of the yarn is composed of yarn having 10-30 individual filaments therein and having a yarn denier within the range of about 30-50d. The preferred caliper of the yarn ranges from .010 to .040 inches. The basis weight of the fabric preferably ranges from 1.0 to 3.0 ounces per square yard.

The aforementioned hook and loop fastener provides fastener characteristics of 6.60 to 20.00 psi shear strength; 200 to 1200 grams per inch peel strength and has a minimum of three refastening functions. In practice, the fastener of the foregoing design has capability of 5 or more refastening cycles at the performance characteristics given above.

The invention provides for use and execution of the mechanical fastener in a variety of garment configurations, designs and uses, some of which are given hereinafter by way of preferred examples.

Some embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings, wherein:-

Fig. 1 is a perspective view of the outside face of a disposable diaper which incorporates a first embodiment of the present invention;

Fig. 2 is a perspective view showing the inside face of the diaper illustrated on Fig. 1;

Fig. 3 is a sectional elevational (partly schematic) view taken along line 3-3 on Fig. 2;

Fig. 4 is a sectional elevational (partly schematic) view taken along line 4-4 on Fig. 2;

Fig. 5 is an enlarged view of the tab of the article on Fig. 3 assembled in its operative position of the mechanical fastener and showing the hook material exposed for attachment with the loop material;

5     Fig. 6 is an enlarged view, similar to Fig. 5, showing the tab folded inwardly in position of storing the hook material of the fastener;

Fig. 7 is a sectional elevational view of a portion of the article of Fig. 2 illustrating another means of  
10     attaching the tab of the fastener to the diaper article in which the inboard end of the tape is laminated between the outer cover or backsheet of the diaper and the topsheet which is placed next to the wearer's skin;

Fig. 8 is a view similar to Fig. 7 showing an  
15     alternative manner of attachment of the tab to the diaper in which the inboard portion of the tape is laminated with the outer cover sheet of the diaper;

Fig. 9 is also a view similar to Fig. 7  
showing another manner of attachment of the tab to the  
20     diaper in which the inboard end of the tape is laminated with the topsheet of the diaper;

Fig. 10 is a perspective view of the diaper and fastening system of the invention as it is applied to the torso of a wearer;

25     Fig. 11 is a plan view of the inner face of a disposable diaper which incorporates a second embodiment of the invention;

Fig. 12 is a perspective view of a disposable  
diaper on the torso of a wearer constructed as the  
30     second embodiment of the invention illustrating the increase of the adjustable size range of the diaper on the wearer of the article as the same may vary in girth;

Fig. 13 is a plan view of the outer face of a  
disposable diaper which incorporates a third embodiment  
35     of the invention;

Fig. 14 is a plan view of the inner face of a disposable diaper that is placed next to the wearer's

skin and which incorporates a fourth embodiment of the invention;

Fig. 15 is a plan view of the inner face of a disposable diaper which incorporates a fifth embodiment  
5 of the invention;

Fig. 16 is an enlarged sectional elevational view (partly schematic) taken along line 16-16 on Fig. 15;

Fig. 17 - 19 are sectional elevational views, partly schematic for ease of illustration, which show  
10 the diaper fastener system of Figs. 15 and 16 in a succession being into use on the first fastening (Fig. 17), in service with the waistband fastened (Fig. 18), and after the fastening system is released to open the waistband (Fig. 19);

15 Fig. 20 representively shows an enlarged, side-elevational view of hook material employed in the present invention;

Fig. 21 representively shows an enlarged, side-elevational view of loop material employed in the  
20 present invention;

The detailed description of the invention is made in connection with preferred embodiments of the invention and in the context of an absorbent disposable diaper article. The described structures of mechanical  
25 fasteners would be suitable for and applicable to other forms of absorbent articles or articles, such as incontinent garments and the like.

Referring to Figs. 1-4, a disposable absorbent garment 10, such as a disposable diaper article,  
30 comprises an elongated backsheet or outer cover 11 having front and rear waistband portions 12 and 13, respectively, at each longitudinal end. The intermediate portion 14 interconnects the waistbands. A pair of leg openings are delimited along the marginal  
35 portions of each lateral side edge 15 and 16 of the outer cover 11. Ear portions 17-20 are delimited at each corner of the outer cover and blend with the leg



openings. Upon placement of the garment 10 about the body of a user, such as a baby (Fig. 10), the longitudinally opposed ears, such as 17 and 20 and 18 and 19 overlap one another, or are engageable with each other, to complete the waistbands 12 and 13 encircling relationship about the torso of the wearer.

The backsheet layer 11 is a liquid-impermeable, substantially inelastic material, such as a polymer film. Examples are polyethylene film and polypropylene film of suitable thickness for flexibility, for example in the range of about 0.75 to 1.5 mils thickness, and is preferably about 1.0 mil. Another example of the backsheet 11 is a layer of a liquid impermeable, but vapor permeable, material such as a breathable, microporous film. Still further examples of backsheet material may comprise anonwoven, fibrous web which has been suitably constructed and arranged to be substantially liquid impermeable. This nonwoven fibrous web may also be constructed to be liquid impermeable but vapor permeable. Such nonwoven fibrous web may be stretchable, and may be treated with a selected polymer coating or film to provide a desired degree of liquid impermeability and vapor permeability.

As shown on Fig. 2, the inside liner sheet, or topsheet element 21 of the diaper article 10, is similar in size and contour to the backsheet element 11. This topsheet 21 is typically comprised of a liquid-permeable, elastic or inelastic and substantially hydrophobic material, for example a spunbonded web of synthetic polymer filaments or meltblown web or bonded carded web of synthetic polymer filaments. Suitable synthetic polymers include polyethylene, polypropylene and polyesters.

An absorbent body, generally indicated at 22 (Fig. 2), is structured and superposed on backsheet 11. The absorbent body 22 may comprise a pad 23 composed of airlaid, cellulosic fibers, such as wood pulp fluff,

having density in range of 0.05 - 0.20 gram per cubic centimeter, and are sufficiently flexible to readily conform to the body of the wearer. As an alternate form, absorbent body 22 may be comprised of a coform material comprising a mixture of cellulose fibers and synthetic material polymer fibers; such as an airlaid blend of cellulosic fibers and meltblown polyolefin fibers (polyethylene and polypropylene fibers being two compositions of the polyolefins). The absorbent body 22 may also include an effective amount of an inorganic or organic high absorbency material to enhance absorptive capacity. Suitable inorganic high-absorbency materials include, as examples, absorbent clays and silica gels. Organic high-absorbency materials include, as examples, pectin, guar gum, and peat moss, as well as synthetic materials, for example, synthetic hydrogel polymers, such as carboxymethylcellulose, alkali metal salts of polyacrylic acids, polyacrylamides, polyvinyl alcohol, ethylene maleic anhydride copolymers, polyvinyl ethers, hydroxypropyl cellulose, polyvinyl morpholinone, polymers and copolymers of vinyl sulfonic acid, polyacrylates, polyacrylamides, polyvinyl pyridine, and the like. Still other suitable polymers include hydrolyzed acrylonitrile grafted starch, acrylic acid grafted starch, and isobutylene maleic anhydride copolymers, and mixtures thereof. The hydrogen polymers are preferably lightly cross-linked to render the materials substantially water-insoluble.

Absorbent body 22 may also include a tissue wrap layer 24 to help maintain the integrity of the fibrous structure 23. This tissue wrap typically comprises a hydrophilic cellulosic material, such as creped wadding or a high wet-strength tissue. The diaper may also include additional components to assist in the distribution and storage of waste material. For example, the diaper may include a hydrophobic transport layer, such as described in U.S. Patent Application

Serial No. 109,784, filed October 16, 1987 of S. Meyer, et al., entitled "Absorbent Article Having a Hydrophobic Transport Layer" of common ownership with the present application.

5        In the embodiment illustrated, as is a typically constructed article, the waist portions 12 and 13 may be provided with an elastic (not shown). This is comprised of a clothlike nonwoven fibrous material, such as an elastomeric stretch-bonded laminate. As an example,  
10        suitable meltblown elastomeric fibrous webs for forming waist elastic are disclosed in U.S. Patent No. 4,663,220. Composite fabrics of at least one layer are described in European Patent Application No. 0 110 010 (April 18, 1987). The composite nonwoven fabrics are  
15        commonly referred to as stretch-bonded laminates. Another material suited for use in the waistband elastic material is a heat shrinkable elastic film of three layer construction. The skin layers are composed of duPont Surylon, Gulf 2491T, Techmer 1094 E16, and duPont  
20        Conpol 8719-3. The core layer is composed of Pebax 3533SA00. The core layer is approximately 80% (by vol.) of the film.

      The leg openings, at the lateral sides 15 and 16, are provided with elastic elements 25 implanted adjacent  
25        the said sides. The leg elastics may be comprised of synthetic and organic elastic film ribbons and used to shirr the leg margin of the garment. Suitable materials for this purpose include, by way of example, natural rubber, or polyurethane materials.

30        The intermediate portion 14 of the diaper 10 is narrower than the waistband portions 12 and 13. As such, the diaper 10 has a generally hourglass shape in plan view. The two ear sections 17 and 18 at the rear  
waistband portion 13 include tape tabs 30 for fastening  
35        the rear waistband 13 onto the front waistband 12 about the body of the wearer.

      The means attached to the diaper for fastening the

front and rear waistbands to each other in an overlapping relationship for encircling the abdomen of the user comprise a hook and loop fastener made up of hook material and loop material components. With reference to Fig. 5, the tape of tabs 30 includes adhesive part 30a and separate tape piece 32 which are adhered together and extend along opposite surfaces of the ear portions 17 and 18. An example of the material for the tab structure is 4.5 mil polypropylene film with titanium dioxide filler (white). Another suitable material for the tab is a 2.0 ounce per square yard spunbond of polypropylene, which provides a porous substrate. The inboard sections of the tape pieces 30a and 30b are fastened onto the backsheet 11 and topsheet 21, respectively, at this point to secure the tabs 30 firmly to the ear portions 17 and 18 of the diaper. The backsheet and topsheet are firmly fastened together at this region in the fabrication of ear portions 17-20. This comprises one preferred form of fastening tabs 30 onto the diaper. On the drawings, Figs. 3-9, the adhesive or bonded areas are schematically shown by the pattern of dots. With the various components of the diaper assembled in the article shown on Fig. 2, they are connected together, as a composite article, by heat bonding, hot melt adhesives or sonic bonds in one of the known techniques for fabrication.

Tabs 30 each include an outboard portion extending beyond the margin of the ears 17 and 18 of the backsheet. The outboard portion of the tab surface is provided with hook tab material 31 bonded to the tape. The free end portion of tab 30 may optionally be folded upon itself at 30d which provides a lift portion at the end of the tape and adjacent hook area 31. This end 30d provides a finger grip or lifting for grasping and releasing the hook material by peeling it from its attachment on the loop material of the fastener. As may be seen on Fig. 6, the tab 30 may be folded inwardly to

an inactive storage position whereat the hook material lightly attaches to the nonwoven material of topsheet 21.

5 The hook material is produced from a process of continuous injection molding of a polymeric material, such as a polypropylene copolymer. It has been determined that the proper stiffness of the material is obtained from the copolymer having flexural modulus of 70,000 - 120,000 psi and shore hardness value within the  
10 range of about D-40 to D-80, preferably about D-61.

The base strata of the hook material is assembled onto the surface of the tab 30 by adhesive, heat bonding or sonic welding to provide the J-shaped hooks in a configuration facing outwardly of the tab structure. As  
15 representively shown in Fig. 20, hooks 60 are tapered from base 62 to top 64 with the tips 66 of the hooks rounded with a discrete radius 68. The radiused tips are substantially without sharp edges which could excessively abrade and irritate a wearer's skin. As a  
20 result, the hook material employed in the present invention can be more "user-friendly". Preferably, the hook material has an alternating hook design wherein immediately adjacent rows of hooks (not shown) have the "mouth" openings 69 of the hooks facing in opposite  
25 directions. The alternating hook design can provide more uniform fastening and securement in all directions. If one desires a more "directional" securement with greater fastening force along one direction than another, the hook material can be configured with all of  
30 the hooks opening along substantially the same direction. A specific example of a suitable hook is the HTH #707 available from Velcro U.S.A. The overall thickness 61 (caliper) of the hook material is in the range of about .035 to .050 inch, and preferably about  
35 0.045 inch. The hooks are attached to a base film 67 which has a thickness 63 in the range of about .005 to .025 inch, preferably a thickness in the range of about

.008 to .010 inch. The hook density on the base is within the range of about 440 to 1040 hooks per square inch; preferably a hook density of about 740 hooks per square inch, as a particular example, hook material  
5 having a row density within the range of about 20-60 rows to the lineal inch of width, preferably a row density of about 40 rows per lineal inch. The material used may be clear or opaque with selected color of the material. The hook material is produced on rolls which  
10 range from 0.25 to 4.0 inches in width. Roll of 1/2 inch width material is preferred. The hook sections 31 placed on the tab 30 are cut to size of approximately 1/2 by 1 inch and bonded on the tab 30. In the example of this embodiment, tab 30 is approximately 1 inch wide.  
15 Referring to Fig. 1, the width of tab 30 lies in the longitudinal direction L on the diaper, accordingly, the hook material 31 is oriented such that, per the example given, the one inch dimension is in the direction L, the 1/2 inch dimension being in the transverse direction T.

20 As representatively shown in FIG. 21, the loop component of the hook and loop fastener is a fabric material 70 comprising yarns 76 arranged to provide a raised loop construction in which the fabric is stabilized (loops 72 are erect from the fabric's base  
25 74) through napping. Additionally, the loop material may be thermoset to impart other properties, such as is set forth in U.S. Patents 3,475,926 issued November 4, 1969 to J. Ruckstuhl and 3,090,097 issued May 21, 1963 to J. Ruckstuhl.

30 Preferably, a material of polyolefin based fibers or other synthetic fibers is used; an example of the fabric being a tricot polyester. More specifically, polyethylene terephthalate (PET) fiber mix in which about 15 -35% of the fabric yarns are yarns composed of  
35 1-15 filaments with the yarn having a denier within the range of about 15-30d, and about 65-85% of the fabric yarns are yarns having about 10-30 filaments per yarn

and having a yarn denier within the range of about 30-50d comprises the fibers used in the fabric. Two bar warp knit construction is preferred in which courses are in the range 21-41 per inch and wales are in the range 26-46 per inch. The surface of the fabric is napped. The thickness caliper 78 is within the range of about .01 to .04 inch, the preferred caliper being about .035 inch. The basis weight of the fabric is in range of 1.0 to 3.0 ounces per square yard; the preferred basis weight being about 1.6 ounces per square yard. The fabric is printable or decoratable directly, or in the alternative may be laminated over a predecorated film base, whereby a print pattern shows through the loop material. Loop material is applied onto the front waistband portion 12 in a patch or swatch 35 with the loops erect and facing outwardly from the face of the back sheet 11 (FIG. 4). The extent of patch 35 may be varied and may take one of several geometric shapes, such as rectangular, irregular shape, diamond, triangle, circle, oval, chevron or the like. One further example of this variable is included in the drawings on FIG. 12, which is hereinafter described. In this regard, the loop material may also be configured as a plurality of patches. The plural patches (two or more) form a landing zone for the hook tabs which are composed of multiple, separate sections. The variation of shape or configuration of multiple patches will lend itself to desired function and size for fastening the waistband about the various sizes of users.

As is shown on FIG. 1, the preferred patch 35 is a rectangular piece cut from a running roll or web of the fabric to size so that the patch extends in the waistband 12 intermediate the ear portions 19 and 20. In the example given above, the patch may be on the order of 2 inch width by 8-10 inches of length. Patch 35 is fastened on the exterior surface of the back sheet 11 by known techniques, such as hot melt adhesive

patterned onto the surface in dots, strips or bars, or fastened by heat bonding. Thus applied, the loop fabric patch 35 is preferably placed in the proximity of the lateral margin of the diaper at its one longitudinal end (depending upon whether elastic is placed along the waistband at this end portion) which corresponds with the front waistband 12 of the article.

Using the hook and loop materials referred to above, the mechanical fastener for the absorbent article provides performance characteristics per the following:

- SHEAR FORCE: about 6.60 - 20.0 psi
- PEEL FORCE : about 200 - 1200 (grams per inch of fastener); preferred is about 400 - 600 grams per inch
- REUSES : Minimum of 3 times; normally minimum of about 3-7 times [refastening uses]; Desirable is 5 times

"Shear" is determined according to ASTM Designation: D3654-82, "Standard Test Method for Holding Power of Pressure-Sensitive Tapes", which is incorporated herein by reference, and subject to the following modifications: In relation to the test, the closure is placed under an increasing load. The system being tested is a hook and loop closure system. (see 1. Scope) The apparatus should include an "INSTRON" or equivalent continuous rate of extension (CRE) tensile tester. (see 3. Apparatus) In carrying out the procedure (see 6. Procedure), test direction of the materials should be noted. The test materials are rolled five cycles (1 sq. in.), where one cycle equals once in each direction. The hook material is clamped into the upper jaw and the loop material clamped into the lower jaw of the Instron tensile testor. The engaged system (hook and loop) is pulled until failure. In doing the calculations (See 10. Calculations), the peak load is determined and recorded in grams.

"Peel" is determined according to ASTM Designation:



D1876-72, "Standard Test Methods for Peel Resistance of Adhesives (T-Peel Test)", which is incorporated herein by reference, and subject to the following modifications:

5           4.1 No test panels are used; hook and loop materials are directly engaged and are not mounted on any other substrate unless specified. Test direction of the materials should be noted. No panels are used. The engaged test materials are  
10           rolled five cycles; where one cycle equals once in each direction. The hook material is clamped into the upper jaw and the loop material is clamped into the lower jaw.

          In a suitable hook and loop fastening system, the  
15           fastener has a total peel resistance of at least about 150 gm. and preferably has a total peel resistance of at least about 400 gm. The total shear force resistance of the fastener is at least about 750 gm. and preferably is at least about 1000 gm. It should be readily recognized  
20           that a suitable fastening system will include a selected balance between the properties of total peel resistance and total shear force resistance. For example, a system with the lower values of peel resistance could be more suitable if the system also exhibited a higher total  
25           shear force resistance.

          For the purposes of the present description, the total peel resistance value corresponds to the peel force determined in accordance with ASTM D1876-72 multiplied by the transverse width of engagement between  
30           the hook material and the loop material employed in the particular fastening system. Similarly, the total shear force resistance value corresponds to the shear stress determined in accordance with ASTM D3654-82 multiplied by the area of engagement between the hook material and  
35           loop material of the fastening system.

          Referring to FIG. 5, the tabs 30 are shown extended with the hooks 31 facing upwardly. In this position,

the diaper article 10 is installed on the wearer (see FIG. 10). The respective tabs 30 on the rear waistband are brought around the abdomen of the baby and the hooks 31 thereof pressed onto the loop material of the patch 35 to close the waistband in a snug position encircling the abdomen. The shirred elastics 25 at the side margins 15 and 16 each encircle a leg of the wearer to provide a good fit of the diaper. The placement of the two hook tabs 31 may vary between the extremes shown on FIG. 10, the solid outline representing a larger size waist and the dotted outline illustrating the smaller size waist for the user of the garment. The diaper may be opened by grasping the end 30d of the tabs 30 and lifting the hooks 31 free from the loop material 35, and thereafter refastened by again pressing the hooks 31 onto a selected zone of the patch 35.

FIG. 6 illustrates the folded position of the garment in which the tabs 30 are folded inwardly. This position places the hook material inwardly of the ear portions and hooks 31 are facing the topsheet 21 at a storage position, i.e. the hooks are exposed to lightly grip the topsheet material 21 when the diaper is packaged prior to use. When ready for use the tabs are folded outwardly to a position like that on FIG. 5 by grasping the end 30d of the tab.

FIG. 7-9 illustrate other variables for attaching the tabs 30 onto the diaper. FIG. 7 illustrates the attachment means whereby the tab 30 is inserted between the backsheet 11 and topsheet 21. The tab is there adhesively secured between the layers 11 and 21 by a hot melt adhesive applied in dot pattern or the like. The backsheet and topsheet are firmly fastened together with the tab between them in forming the laminated ear portion of diaper 10.

FIG. 8 illustrates an alternative attachment means in which the topsheet 21 and backsheet 11 are fastened together, such as by adhesive or by heat bonding in

known manner. The tab 30 is attached to the exterior surface of the backsheet 11 by hot melt adhesive or heat bonding. The lamination of the three layers 21, 11 and 30 may be accomplished in one step, or accomplished  
5 separately.

FIG. 9 illustrates another means of attachment of the tabs 30 onto the topsheet 21 of the diaper where topsheet 21 and backsheet 11 are laminated to each other.

10 The tabs 30 are generally attached to the diaper ear portions, as illustrated on FIGS. 5 and 7-9 such that tab 30 extends laterally about 0.5 to 3.5 inches and preferably extends about 1.5 to 3 inches past the outside edge of the diaper ear portion. In this  
15 arrangement, the minimum waist girth dimension is the point at which the tab 31 are positioned at the outer opposite edges of the loop fabric 35 so that all of the hook material area of the tab is positioned on and engages loops of the patch 35.

20 A second embodiment of the invention is shown on FIGS. 11 and 12. The same or similar parts are identified with the same reference numeral, as used earlier herein. FIG. 11 is a view of the baby diaper in which the backsheet 11 is lowermost and the topsheet 21  
25 is uppermost; in other words, on this view the inside surface of the garment is shown. The contour of the diaper is formed from a liquid-impermeable backsheet 11, a liquid-permeable topsheet 21 in facing superposed relation with the inner surface of the backsheet, and an  
30 absorbent body 22 is located between the backsheet 11 and topsheet 21. A waist elastic 34 is attached to rear waistband portion 13 of the overlying sheets 21 and 11 and arranged to shirr the waistband portion. Leg  
35 elastic members 25 are attached to the respective side margins 15 and 16 of the garment and configured to gather and shirr the leg band portions of the garment to seal about the leg of the wearer.

In this embodiment of the invention, the diaper includes opposite side panels 36 and 37 alternatively may be composed of a liquid-permeable material, may be elastic, or may be composed of plastic film. Side  
5 panels 36 and 37 are attached along longitudinal sides 38 and 39, respectively, of the composite topsheet and backsheet to provide the ear portions of the rear waistband of the diaper. The side panels may be attached in suitable overlapping fashion, their  
10 innermost edges 40 lying inboard and along line of the side margins 15 and 16.

A tab 41 of hook material is attached directly onto each of the side panels 36 and 37, preferably placed such that the long dimension (length) of the tab extends  
15 longitudinally of the garment (direction L on FIG. 1) and the short dimension (width) of the tab extends laterally (direction T) of the garment. The hook tab 41 may be on the order of 1 inch long and  $\frac{1}{2}$  inch wide. The tab 41 is adhesively bonded to the inner surface of  
20 the side panel facing upwardly, as shown on FIG. 11. The hook tab 41 is constructed of the hook material described earlier herein. Tab 41 may be heat bonded or sonic welded directly to the side panel material, or fastened by hot melt pressure-sensitive adhesive in its  
25 longitudinally oriented position on the diaper.

Under the construction described, alternatively the positioning of the hook material and loop material may be reversed. Loop material may be secured to tab 41, and the hook material may be secured to the diaper outer  
30 cover in proper placement thereon.

As shown on FIG. 12, the waist girth variable is enhanced in this embodiment by the fact the ear portions 36 and 37 of the diaper along the rear waistband may be brought together in substantially an abutting  
35 relationship to provide the minimum size or girth (see dotted outline) as contrasted with the maximum girth whereat the hook tabs 41 are placed at the extreme

lateral edge of the loop material on patch 35. Also, the dimension of the hook tab in the girth direction (lateral direction on the diaper) is the smaller width dimension. This allows approximately a one to one and one-half inch gain in girth variable, yet the same area of hook fastener is being utilized for holding the waistband closed. And, the stress forces in the waistband are distributed over a wider band, that is a band width that is the same as the length of the hook tabs.

Referring to FIG. 13, the diaper incorporates the mechanical fastening system in which a chevron-shaped patch 43 of the loop material is adhesively bonded onto the outer surface of backsheet 11 by placement in the front waistband region 12 of the diaper. Chevron-shaped patch 43 provides an attachment zone for the hook tabs 30 at the rear waistband 13 which enhances the leg fit of the diaper on the wearer, yet minimizes the amount of the loop material used in the fabrication of the garment's attachment patch.

FIG. 14 illustrates a further embodiment of the invention. The absorbent article 44 includes a liquid-impermeable backsheet 11, a liquid-permeable topsheet 21 located in facing relationship with the inner surface of the backsheet and an absorbent body 22 is located between the topsheet and backsheet. A waist elastic member (not shown) may be arranged to shirr the front waistband 12. Leg elastic members 25 are attached at the side margins 15 and 16, respectively, configured to gather and shirr the leg margins of the garment to form seals or gaskets about the leg of the wearer. A rear waistband portion 47 is attached along the rear margin 13 such that the ends 48 and 49 of waistband portion 47 extend outwardly to form ears. The mechanical fastener components, earlier described, are attached to the diaper, such as, the hook tabs 45 are adhesively attached in each of the ears 48 and 49 of waistband 47.

The hooks of the hook material extend in the direction of the body of the wearer to be attached on the patch 46 of loop material adhesively connected on the outside surface of backsheet 11 at the front waistband 12. As shown, the waistband 47 is adhesively attached to overlap the marginal edge at 13 of the article and extend longitudinally outwardly along the L axis of the diaper. The waistband 47 may be made of an elastomeric material to provide an elastic component of the waistband. The hook tabs 45 are attached onto the material of the ears 48 and 49 to face inwardly (as shown on FIG. 14) in the fashion described for FIG. 11. The long dimension of the hook tab is shown as parallel with the longitudinal axis L of the diaper, however, the tab 45 may be alternatively fastened thereon such that its long dimension extends transversely (direction T) of the diaper 44.

FIGS. 15-19 show a further embodiment of the invention wherein the hook and loop fastening system is employed having the loop material, as part of the target patch, which may be placed selectively on the outer cover by the user upon first use of the garment. The absorber article 50 is a disposable diaper shaped and constructed similarly to the diaper shown on FIGS. 1-4 described earlier herein. The hook tabs 30 are connected to the ear portions 17 and 18 at the rear waistband of the diaper in the manner described such that the hooks of the tabs face upwardly (inwardly of the diaper as viewed on FIG. 2). In the fabrication of the diaper 50, a target patch 51 of loop material is releasably attached to hook material 31 of the tab 30, as shown on FIG. 16. A pressure-sensitive adhesive layer 52 is constructed on the patch 51 at its surface opposite the loops. When stored on the diaper, adhesive layer 52 is positioned against a release layer, such as a piece of release paper 53, to prevent the adhesive from fastening itself in random, unwanted fashion.

Optionally, the release layer may comprise an inboard portion of tab 30 treated with a release coating against which adhesive layer 52 rests when tab 30 is inwardly folded to its storage position.

5        During use, the release paper 53, if used, is manually removed and the composite assembly comprising tab 30,31 and target patch 51,52 is positioned in a desired fastening position against the outer surface of backsheet 11. Adhesive layer 52 then secures the target  
10       patch to the surface of outer cover 11 (See FIGS. 17-18). Adhesive layer 52 is sufficiently strong such that the target patch 51 remains adhered to the outer surface of the diaper when hook material 31 on the tab is pulled away from the loop material of patch 51 (See FIG. 19).  
15       Thereafter, the hook tab 30,31 can be refastened against the loop material of patch 51 now adhesively attached onto the backsheet 11 of the diaper in the initial placement position. Pressure-sensitive adhesive tape materials for constructing the loop material patch 51,  
20       as described, are available from 3M Company, St Paul, Minnesota. The tape adhesive preferably has an average peel adhesion force of at least about 11.7N. Peel force values may be determined in accordance with procedures of ASTM-D1876-72, referenced above herein.  
25       Thus at least in its preferred embodiments the invention is directed to an absorbent article having a hook and loop mechanical fastener system, such as a Velcro-style fastener, specifically developed for disposable garments, in particular disposable diapers  
30       and incontinent garments. The hook and loop materials are lightweight, and provide a secure fastener system capable of refastening securely at least three times for opening and reclosing the garment. The absorbent article of the invention provides a mechanical fastening  
35       system that possesses flexibility, softness and is low cost to produce; yet resists contamination that will interfere with its function as a fastener, and is

adaptable to a wide range of sizes or girth of the user.

Having described various embodiments of the invention in detail, it will be readily apparent to those ordinarily skilled in the art that various changes and modifications may be made without departing from the scope of the invention as set forth in the appended claims.

The words "Velero", "du Pont", "Pebax" and "Instron" are registered Trade and/or Service Marks.



Claims

- 5 1. An absorbent article having superposed outer cover,  
absorbent body and topsheet elements connected together  
to provide an elongated composite of selected shape,  
opposite longitudinal end portions of said  
composite providing first and second waistband portions,  
10 respectively, which are adapted to overlap each other to  
encircle a user's body,  
a pair of ear portions disposed at opposite ends of  
said first waistband portion,  
a means for fastening the first and second  
15 waistband portions to each other in said overlapping  
relationship, comprising:  
a mechanical fastener which includes interlocking  
hook and loop materials located on each ear portion,  
said hook and loop materials providing a first component  
20 and a second component with each first component having  
a surface for releasably engaging a surface of said  
second component,  
said first component of one of said mechanical  
fasteners being attached to each of said ear portions at  
25 a surface of said first component which is opposite the  
engaging surface thereof, with each first component  
having a target patch of said second component  
releasably engaged therewith,  
each target patch of said second component having a  
30 pressure-sensitive adhesive on its surface opposite said  
engaging surface thereof, said pressure-sensitive  
adhesive constructed for storage positioning against a  
release layer and adapted to separate from said release  
layer to selectively attach said second component to the  
35 composite on its second waistband portion and secure the  
first and second waistband portions about the body of  
the user,

said engaging surfaces of said first and second components thereby releasably attaching the first and second waistband portions about the body of the user.

- 5     2.    An absorbent article as recited in claim 1, wherein one of said first or second components comprises a hook material molded of a polymeric material having a flexural modulus of about 70,000 - 120,000 psi and Shore hardness of about D-40 to D-80, said material including  
10    hooks of a configuration that is tapered from base to tip and caliper of about 0.035 - 0.050 inch.
- 15     3.    An absorbent article as recited in any preceding claim, wherein one of said first or second components  
16    comprises a loop material which includes a knit fabric of polyethylene terephthalate (PET) and of raised and stabilised loop construction, said fabric including fabric yarns in which about 15% - 35% of the fabric  
20    yarns are yarns having 1 - 15 filaments per yarn and a yarn denier within the range of about 15 - 30d and in which about 65% - 85% of the fabric yarns are yarns of about 10 - 30 filaments per yarn and having a yarn denier within the range of about 30 - 50d.
- 25     4.    An absorbent article as recited in any preceding claim, wherein said first component is connected to said opposite ear portions by attachment means which include a tab attached to each ear portion, the first component is attached to an outboard portion of the tab, and said  
30    release layer comprises an inboard portion of said tab having a release coating thereon against which the said adhesive layer of said target patch rests when said tab is inwardly folded to a storage position.
- 35     5.    An article as recited in any preceding claim, wherein said hook material includes a polymeric base material of about 0.005-0.025 inch thickness.

6. An absorbent article as recited in any preceding claim, wherein said hook material includes hooks on a base film having a thickness within the range of about 0.008-0.01 inch.
- 5
7. An absorbent article as recited in any preceding claim, wherein said hook material includes hooks that are tapered base to tip, the hook material has a total caliper within the range of about 0.04-0.05 inches, and
- 10 the hook material has a hook density of approximately 740 hooks per inch over 40 rows per inch.
8. An absorbent article as recited in any preceding claim, wherein said outer cover includes a substantially
- 15 liquid impermeable, polyolefin backsheet material.
9. An absorbent article as recited in any preceding claim, wherein said loop material has a caliper in the range of about 0.01 to 0.04 inches.
- 20
10. An absorbent article as recited in any preceding claim, wherein said loop material comprises a fabric having a total, composite caliper of about 0.02-0.06 inch.
- 25
11. An absorbent article as recited in any preceding claim, wherein said loop material comprises a fabric having a basis weight in the range of about 1.0-3.0 oz per square yard.
- 30
12. An article as recited in any preceding claim, wherein said loop material is a polyester fabric of raised loop construction.
- 35
13. An absorbent article as recited in any preceding claim, wherein said loop material comprises a two bar, warpknit fabric providing a raised loop construction and a napped surface.

14. An article as recited in any preceding claim,  
wherein approximately 26% of the loop material is  
composed of the fabric yarns having a denier within the  
range of about 15-30d, and approximately 74% of the loop  
5 material is composed of fabric yarns having a denier  
within the range of about 30-50d.

15. An absorbent article as recited in any preceding  
claim, wherein said loop material comprises a  
10 polyethylene terephthalate (PET) tricot fabric, said  
fabric being a two bar warpknit providing a raised loop  
construction and a napped surface, said fabric including  
PET fiber yarns in which approximately 26% of the PET  
yarns are yarns having a denier within the range of  
15 about 15-30d and in which approximately 74% of the PET  
yarns are yarns having a denier within the range of  
about 30-50d, wherein said warpknit fabric has about 31  
courses per inch, about 36 wales per inch and a basis  
weight of approximately 1.6 ounces per square yard.

20

16. An article as recited in any preceding claim,  
wherein: said loop material is a polyester tricot fabric  
of raised loop construction; approximately 26% of the  
fabric is composed of yarns having a denier within the  
25 range of about 15-30d and approximately 74% of the  
fabric is composed of yarns having a denier within the  
range of about 30-50d; the courses of the fabric are  
about 31 per inch and the wales are about 36 per inch;  
and the basis weight of said fabric is approximately 1.6  
30 ounces per square yard.

17. An absorbent article as recited in any preceding  
claim, wherein said hook and loop materials provide for  
a fastening engagement therebetween which has properties  
35 of shear of about 6.6-20 psi and peel of about 200-1200  
grams per inch of width.

**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

Application number

GB 9217430.9

**Relevant Technical fields**

- (i) UK CI (Edition <sup>K</sup>) A3V
- (ii) Int CI (Edition <sup>5</sup>) A61F 13/62, 13/66

**Search Examiner**

D BUCKLEY

**Databases (see over)**

(i) UK Patent Office

(ii)

**Date of Search**

20 OCTOBER 1992

Documents considered relevant following a search in respect of claims

1 TO 17

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2174290 A (KIMBERLEY-CLARK CORP) - whole document	1 at least
X	GB 2091986 A (UNI-CHARM CORP) - whole document	1 at least
X	GB 2035053 A (KOA SOAP CO) - whole document	1 at least
X	GB 1593710 (AVERY INTERNATIONAL) - whole document	1 at least

Category	Identity of document and relevant passages	Relevance to claim(s)

#### Categories of documents

**X:** Document indicating lack of novelty or of inventive step.

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**P:** Document published on or after the declared priority date but before the filing date of the present application.

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